HIPO Spectral Passbands

SOFIA

Wavelength range: **0.3 – 1.1 µm**

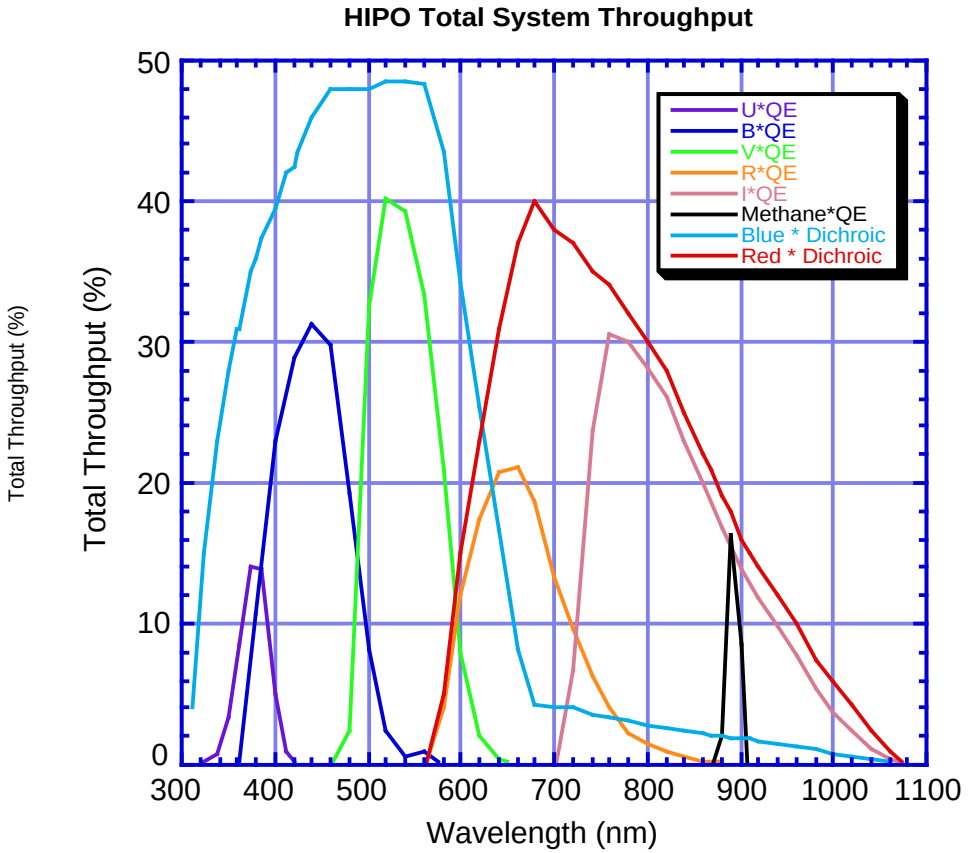
Dual-channel high-speed direct imaging photometer. Modes include:
- Single frames
- Shuttered time series
- Frame transfer time series up to 50 Hz
- Short time series up to 10 KHz

Broadband imaging filters:
- Standard UBVRI passbands

Narrow-band filters at, e.g.:
- Methane filter at 0.89 µm

Dichroic Reflectors:
- HIPO will use a dichroic reflector to separate its channels. The transition wavelength for the first light dichroic has not been determined.

Additional Filters:
- Additional custom filters will be added for specific events



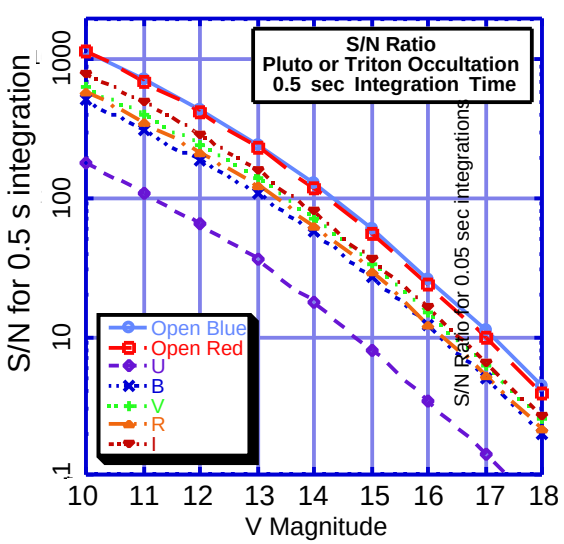
HIPO will include standard Johnson filters at first light that will be used primarily for facility performance testing. Occultation observations will normally be unfiltered for events involving faint stars or will use specialized filters such as the methane filter shown here for events with bright stars. The dichroic response shown here is only an example.

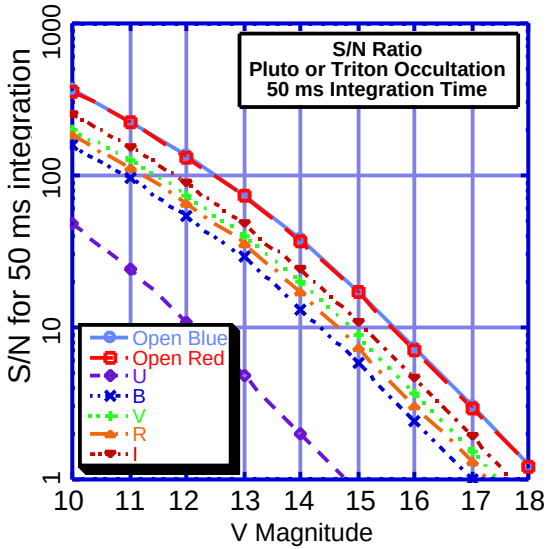
HIPO Sensitivity

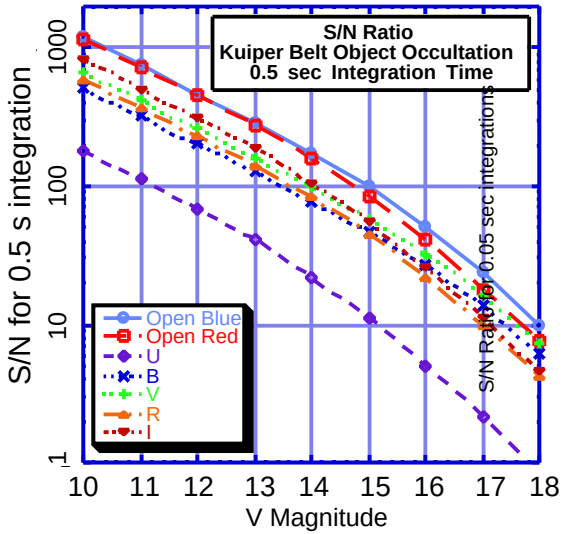
SOFIA

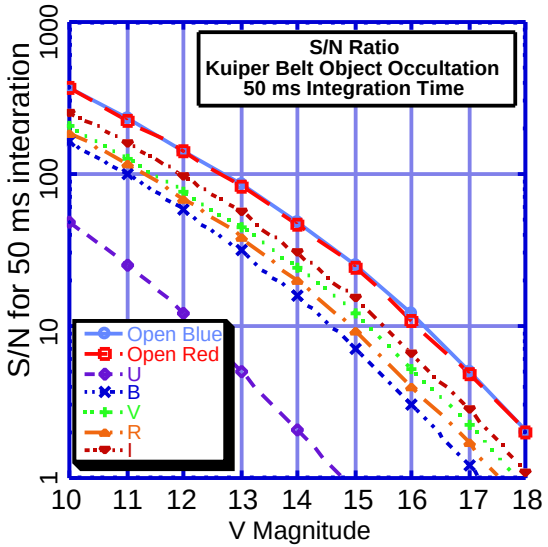
HIPO first-light sensitivity is shown here for several representative cases. The upper figures correspond to occultations by Pluto or Triton while the lower two are for the case of a very faint occulting object. The left and right figures are for 0.5 sec and 50 ms integrations, respectively. Each figure shows S/N for no filter (dichroic only) and for the dichroic plus standard Johnson filters. The dichroic transition is assumed to occur from 0.57 and 0.67μm.

The deviation of S/N from a square root dependence is mostly due to shot noise on the occulting object in the top two figures, mostly to shot noise on the sky in the bottom left figure, and mostly to read noise in the bottom right figure. The improved final SOFIA pointing stability will increase sensitivity for sky-limited events and improve discrimination from nearby bright objects (e.g. Neptune for a Triton occultation).





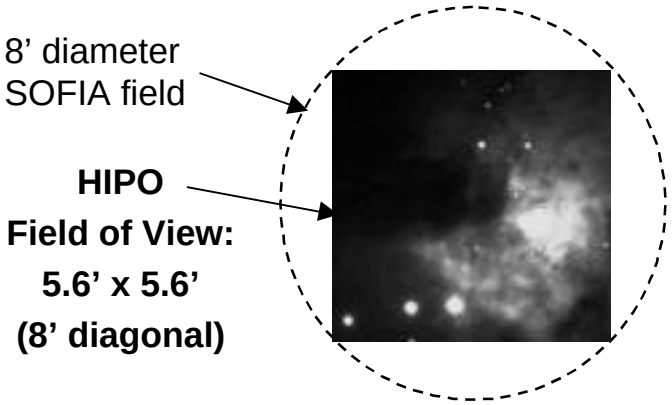


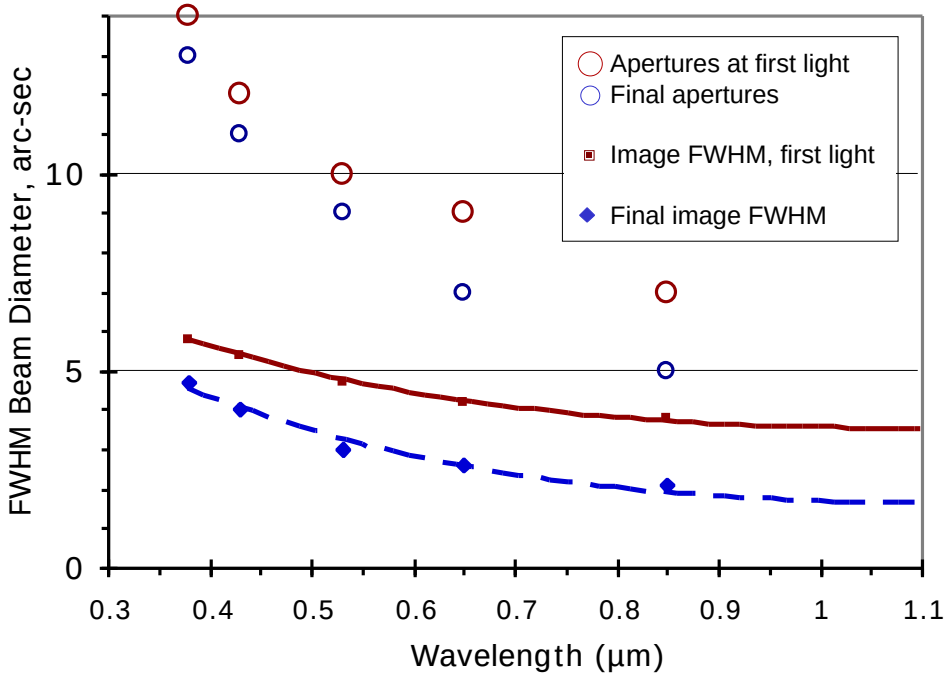


Format: 1024 x 1024 pixel array
Low resolution: 0.33” x 0.33” pixel
High resolution: 0.05” x 0.05” pixel

Pixels will normally be binned to best match the seeing blur size and to reduce the effect of read noise. High resolution mode includes no reimaging optics and will be used for shear layer imaging tests and for maximum throughput for certain occultations. Occultation photometry will be extracted from data frames using effective aperture sizes comparable to the 80% enclosed light diameter plotted here.

The HIPO field is a 5.6’ square inscribed in the 8’ diameter SOFIA field.





This figure shows the expected instrument FWHM beam diameter as a function of wavelength. It is expected to be dominated by seeing and image motion effects. The red curve in this figure is the nominal image quality expected at first light for SOFIA, based on the expected shear layer seeing, the as-built optical performance, and 2” rms image motion. The blue curve represents the ultimate combined optical quality and image motion requirement (80% encircled energy in a 1.6” diameter circle) convolved with the expected shear layer seeing. Also plotted are representative photometry aperture diameters likely to be used for processing occultation frames under both conditions described above. The image motion assumed is larger than will be experienced when observing at high frame rates.